

ENGG*4430

Neuro-fuzzy and Soft Computing Systems

Winter 2008

Instructor:

- Dr. Simon Yang **Office:** Room 2387; **Phone:** ext. 52437; **Email:** syang@uoguelph.ca; **Office hours:** 9:30-11:30 am, Wednesday

GTA:

- Baozeng Jia

Lecture Schedule:

- 2:30-3:50 pm on Tuesday and Thursday in MACK 121.

Text Book:

No specific textbooks will be assigned. Follow lecture notes and use the following references:

- *Soft Computing & Intelligent Systems Design*, by Karray & De Silva, Addison-Wesley, 2005.
- *Neuro-fuzzy and Soft Computing*, by Jang, Sun & Mizutani, Prentice Hall, 1997.
- *An Introduction to Fuzzy Sets*, by Pedrycz & Gomide, MIT Press, 1998.
- *Evolutionary Computation*, by Dumitrescu et al., CRC, 2000.

Course Web Page:

- <http://www.uoguelph.ca/~syang/Engg4430/>

Course Email Group:

- engg443@aris.eos.uoguelph.ca

Prerequisite:

- ENGG*3410

Corequisite:

- ENGG*4280

Course Objectives:

Students who successfully complete this course will be able to:

- Have a general understanding of soft computing methodologies, including biological and artificial neural networks, fuzzy sets and fuzzy logic systems, and hybrid neuro-fuzzy systems;
- Develop computational neural network models for some simple biological systems;
- Develop fuzzy models for engineering systems, particularly for control systems;

- Combine neural networks and fuzzy systems to design neuro-fuzzy control and inference systems;
- Appreciate the pros and cons of intelligent control systems and compare their performance to that of classical control systems.

Materials to be Covered (Tentative):

The tentative topics and schedule of this course are listed as the following:

- **Introduction:** Introduction to soft computing; introduction to biological and artificial neural network; introduction to fuzzy sets and fuzzy logic systems. (Week 1)
- **Biological neural networks:** generalization of single neuron; neural dynamics; additive and shunting neural networks; short term and long-term memory. (Week 2-4)
- **Artificial neural networks and applications:** artificial neural network models; learning in artificial neural networks; neural network applications in control systems. (Week 5-8)
- **Fuzzy systems and applications:** fuzzy sets; fuzzy reasoning; fuzzy inference systems; fuzzy control; applications of fuzzy systems. (Week 9-11)
- **Neuro-fuzzy systems:** neuro-fuzzy modeling; neuro-fuzzy control. (Week 12)

Grade Evaluation:

- Assignments 10%
- Term Project 35%
- Mid-term Exam 20%
- Final Exam 35%

Note: All the exams will be closed book, with a letter-size one-page formula sheet. The **mid-term** test is scheduled on Tuesday, **Feb. 26** at 2:30-3:50 in class. The **final exam** is on Thursday, **Apr. 10**, at 7:00-9:00 pm. Students can select the Graduate Option (for details, see the Guidance for Term Project).

Term Project:

Each student is required to complete a term project as part of this course. The project will involve a proposal and a final report. Projects can be done individually or in a group of up to 3 students. Grading for the projects will include:

- Proposal 5%
- Final Presentation 5%
- Final Report 25%

Academic Misconduct:

Please refer to the regulations outlined in the student handbook regarding academic misconduct. The policy for this course is zero tolerance for any form of academic misconduct.

Major Holy Days:

The student must contact the instructor within the first two weeks of class if academic consideration is to be requested due to religious reasons.